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Indian Standard

SPECIFICATION FOR SECTIONAL COLD ROOMS (WALK-IN TYPE)

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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SPECIFICATION FOR SECTIONAL COLD ROOMS (WALK-IN TYPE)

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Indian Standard
SPECIFICATION FOR SECTIONAL COLD ROOMS (WALK-IN TYPE)

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 23 May 1963, after the draft finalized by the Refrigeration and Air-Conditioning Sectional Committee had been approved by the Building Division Council.

0.2 The refrigeration and air-conditioning industry in the country has made substantial headway during the last few years and efforts are being made to manufacture all the components indigenously not only to meet internal needs of the country but also to export the goods made to foreign markets. It is necessary in this connection that the indigenously manufactured units should, besides conforming to minimum standards of manufacture, performance and ratings, also be able to compete both in quality and price in the foreign markets. Keeping these aspects in view, the Refrigeration and Air-Conditioning Sectional Committee is formulating a series of standards in this field. Standards dealing with equipment, such as domestic and commercial refrigerators, room air-conditioners and water coolers have already been published and others are under formulation. This standard covers the minimum requirements for sectional cold rooms of walk-in type used in preserving the quality and appearance of bulk articles and other goods.

0.3 The Sectional Committee responsible for the preparation of this standard has taken into consideration the views of manufacturers, consumers and technologists and has related the standard to the manufacturing and trade practices followed in the country in this field. Due weightage has also been given to the need for international co-ordination among standards prevailing in different countries of the world. These considerations led the Sectional Committee to derive assistance from B.S. 2502 : 1954 Manufacture and Testing of Sectional Cold Rooms (Walk-In Type) issued by the British Standards Institution.

0.4 Wherever a reference to any Indian Standard appears in this specification, it shall be taken as a reference to the latest version of the standard.

0.5 Metric system has been adopted in India and all quantities and dimensions in this standard have been given in this system.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960 Rules for Rounding Off Numerical Values (*Revised*). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

0.7 This standard is intended chiefly to cover the technical provisions relating to sectional cold rooms (walk-in type), and it does not include all the necessary provisions of a contract.

1. SCOPE

1.1 This standard covers the general construction requirements, methods of computing volumes and shelf areas of sectional cold rooms within the range of 3 000 to 45 000 litres gross volume capacity and operated by an electrically driven refrigerating machine of the vapour compression type. The methods of carrying out tests on sectional cold rooms are also specified.

1.1.1 The limits of internal and ambient temperature covered by the standard are:

Internal cabinet temperature	− 26°C to + 12°C
Maximum ambient shade temperature	+ 43°C

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions shall apply.

2.1 Sectional Cold Room — A complete unit comprising:

a) the refrigerating system;

b) the insulated cold room, made in transportable sections generally in the manufacturer's works; and

c) all auxiliaries, such as fans, lights, etc, the complete unit being capable of removal from one site and re-erection on another without interference with the main structure of a building.

2.2 Frozen Food Storage Compartment — The part of the cold room specifically arranged for frozen food storage.

2.3 General Storage Compartment — The part of the cold room specifically arranged for general cold storage.

2.4 Freezing Compartment — The part of the cold room specifically arranged and fitted for the freezing of water, ice-cream mix or other foods.

2.5 Insulation (Thermal) — A material of low thermal conductivity employed for the purpose of resisting heat flow.

2.6 Transmittance (Thermal) — The quantity of heat flowing per unit time through unit area of a wall or partition, divided by the temperature difference between the air or other fluid on either face.

2.7 Refrigerating System — The condensing unit, evaporator, valves piping, etc, through which the refrigerant circulates.

2.8 Vapour Compression Cycle — A refrigeration cycle in which a volatile liquid absorbs heat by evaporation and, after being mechanically compressed, surrenders heat during liquefaction at a higher temperature level.

2.9 Refrigerant — The volatile liquid used in a vapour compression cycle.

2.10 High Pressure Side — The part of the refrigerating system subject to the higher or condenser pressure.

2.11 Low Pressure Side — The part of the refrigerating system subject to the lower or evaporator pressure.

2.12 Evaporator (Cooling Unit) — The part of the refrigerating system which performs the function of absorbing heat.

2.13 Condensing Unit — The part of refrigerating system which is responsible for condensing the evaporated gas back to liquid form. It mainly comprises a power-driven compressor; a condenser; and a receiver, if any.

2.14 Hermetically-Sealed Compressor Unit — Hermetically-sealed compressor unit is a unit similar to the one described in **2.15**. The main difference, however, is that the compressor and the motor are enclosed in a steel shell, which is rendered gas-tight by welding or brazing. In order to take this unit apart, it becomes necessary to cut the welded dome.

2.15 Semi-Hermetically Sealed Compressor Unit — A compressor unit in which a compressor and a motor are enclosed within the refrigerating system but shall be so constructed that the compressor or the motor can be unbolted and taken apart.

2.16 Walk-In Type — A cold room wherein a person can enter and reach any part of the cold room.

3. COLD ROOM

3.1 Inside Dimensions

3.1.1 *Inside Depth* — The inside depth shall be the mean horizontal distance between the inside surfaces of the front and back inner walls of the lining.

3.1.2 *Inside Width* — The inside width shall be the mean horizontal distance between the inside surfaces of the side inner walls of the lining.

3.1.3 *Inside Height* — The inside height shall be the mean vertical distance between the inside surfaces of the floor and ceiling of the lining.

3.2 Computation of Volume

3.2.1 *Gross Volume* — Gross volume shall be the product of inside depth, inside width and inside height. It shall be expressed to the nearest 50 litres up to 10 000 litres and nearest 100 litres for sizes beyond 10 000 litres.

3.2.2 *Net Shelf Area* — Net shelf area shall be stated to the nearest 0·1 m^2.

4. CONSTRUCTION

4.1 General

4.1.1 The cold room and its parts shall be constructed with strength and rigidity adequate to normal conditions of handling transport and usage.

4.1.2 All joints between sections shall be so formed as to become rigid and air-tight after erection, and yet allow of the sections being dismantled and properly re-erected, if required.

4.1.3 Under normal usage, all moving parts which constitute an accident hazard shall be effectively guarded.

4.1.4 All parts which require periodical servicing shall be readily accessible.

4.1.5 Doors of all compartments shall be arranged for access from both inside and outside. Where so desired, an electric alarm signal may be provided in a convenient position.

4.2 Cold Room

4.2.1 *Materials*

4.2.1.1 Materials used in the construction of the cold room shall comply with Indian Standards where applicable, except where such requirements are otherwise modified by this standard. They shall be free from defects which are liable to cause undue deterioration or failure.

4.2.1.2 Under normal conditions of use, the materials used shall not shrink, warp or cause mould or odours, and shall be resistant to attack by vermin and destructive pests; where liable to be exposed to moisture, food products or chemically active substances, they shall be suitably resistant, and shall not contaminate stored products placed in contact with them. Sealing materials used shall not lose any of their essential properties, such as adhesion, plasticity and moisture resistance.

4.2.2 *Interior and Exterior Finish* — Internal and external finishes shall be durable and capable of being cleaned effectively and hygienically without undue deterioration. All metal parts used inside the cold room or on the outside, where they are liable to be exposed to moisture shall be corrosion resistant or adequately protected against corrosion. Finishes shall not crack, chip, flake, rub off or soften under conditions of normal service and cleaning.

4.2.2.1 Where organic finishes are employed, protection against corrosion shall be provided in accordance with the recommendations made in IS : 1477 (Part I) - 1959 Code of Practice for Finishing of Iron and Steel in Buildings, Painting and Allied Finishes : Part I Operation and Workmanship. Electroplated metal parts used in construction of sectional cold rooms shall conform to Grade B of IS : 1068-1958 Specification for Copper, Nickel and Chromium Electroplated Coatings. For parts used internally the standard shall be that for severe outdoor conditions or extra hard wear.

4.2.2.2 Cadmium plating shall not be used on any part of the storage space or its fittings.

4.2.2.3 Where vitreous enamelled parts are fitted suitable means shall be provided to prevent chafing or mechanical stress likely to cause chipping. Where liable to contact with food products or their derivatives or other chemically active substances the enamel shall be suitably resistant.

4.2.3 *Thermal Insulation*

4.2.3.1 The quality, thickness and application of the insulating material shall be such that the efficient insulation of the cold room is reasonably maintained. The whole of the external surface shall be sealed against moisture penetration by diffusion. Where the insulation space is vented to the inside, steps shall be taken to ensure that particles of the insulating material cannot escape into the storage compartment.

4.2.3.2 Where the moisture barrier is broken by door locks, pipes, hinges, etc, the points of entry shall be suitably sealed. Detachable plates and covers on the external surfaces shall also be provided with suitable seals against ingress of moisture into the insulation.

4.2.3.3 Where the internal and external surfaces are of high heat conducting materials, they shall be separated by insulating breaker strips or their equivalent, to ensure that all external surfaces shall be reasonably free from condensation under normal conditions of service.

4.2.3.4 Frame members within the insulation shall be kept to a minimum consistent with adequate constructional rigidity and loading applied in use. Where possible frame members shall not penetrate the full thickness of the insulation.

4.2.3.5 The type and quality of gaskets and hardware used on access doors, hatches, plugs, etc, shall be such that efficient insulation is reasonably maintained.

Suitable provision shall be made to ensure that all external surfaces of the cabinet shall be reasonably free from condensation under normal conditions of service.

4.2.4 *Internal Linings and External Facings* — Linings and facings shall have sufficient mechanical strength to resist distortion and give reasonable protection to the insulation.

4.2.5 *Exclusion of Air* — When the doors of the refrigerated space are closed there shall be no appreciable leakage of ambient air into the interior, either past the door gasket or by any other means.

4.2.6 *Hardware* — Door fasteners and hinges shall be smooth and positive in action and designed to maintain their proper functioning without undue wear under normal conditions of service.

4.2.7 *Water Condensation* — Suitable means shall be provided to prevent moisture dripping or splashing from baffles, drip trays or other cold parts on to the food or other products placed in the cold room.

4.2.8 *Defrosting* — Means shall be provided for collecting the defrost water from the cooling unit either by a removable tray or by a fixed receptacle with suitable means for draining.

4.2.9 *Drains* — Where drains are fitted they shall have ample capacity to cope with the requirements of normal service and shall be suitably sealed against ingress of air; they shall also be accessible for cleaning.

4.2.10 *Interior Fittings* — Hanging rails and shelves shall be of robust construction, rust-proof and shall be adequately supported.

4.2.11 *Minimum Internal Height* — Unless otherwise specified, the minimum internal height of cold rooms of 3 000 to 6 000 litres capacity shall be 1·8 m. The minimum internal height of cold rooms over 6 000 litres shall be 2 metres.

4.2.12 *Minimum Door Opening Sizes* — Unless otherwise specified, the minimum clear opening size of doorways, (a) on cold rooms of 3 000 to 6 000 litres capacity shall be 1·7 m high × 0·7 m wide; and (b) on cold rooms over 6 000 litres capacity shall be 1·8 m high × 0·7 m wide.

4.2.13 *Multiple Compartments* — Where special compartments are provided for the storage of produce or goods likely to contaminate food substances, they shall be adequately sealed from the remainder of the cold room.

5. REFRIGERATING SYSTEM

5.1 Construction

5.1.1 Pipes and connections to moving or resiliently-mounted parts shall be so arranged as not to foul or to transmit vibrations to other parts. All other pipes and connections shall be secured, and sufficient free length shall be provided to minimize the risk of failure due to fatigue.

5.1.2 Where necessary under normal operating conditions, pipes and valves shall be thermally insulated.

5.2 Noise — The refrigerating system shall be free from undue noise or vibration.

5.3 Water Condensation — Suitable means shall be provided to prevent water condensed on cold parts of the refrigerating system from affecting the operation of the unit or its controls.

5.4 Safety Features in Design (Operation of Safety Device) — The refrigerating system shall be so designed that it will suffer no damage if a door, hatch or plug of the cold rooms is left open accidentally in ambient air of the temperature specified in the conditions of contract (*see* **1.1.1**).

5.4.1 When the door or hatch is left open under normal operating conditions, the automatic motor overload protective device may come into operation.

5.5 Control of Operation — Refrigerant flow and compressor driving motor operation shall be automatically controlled to reduce the cabinet temperature to the temperature specified and to maintain it within the limits of the application.

5.6 Location of Components — The evaporator and any associated screens, baffles, drip tray, etc, shall not obstruct access to stored products. All control devices and service valves shall be readily accessible. Where the evaporator incorporates facilities for making ice, the ice trays shall be capable of being removed without disturbing stored products.

6. ELECTRICAL EQUIPMENT

6.1 Rating of Motors — All motors shall be of types suitable for their particular applications. Motors, other than those of hermetically-sealed compressor units, shall comply with*IS : 325-1961 Specification for Three-Phase Induction Motors (*Second Revision*) or*IS : 996-1959 Specification for Small AC and Universal Electric Motors and Class A Insulation, whichever is applicable. Motors complying with *IS : 325-1961 where applicable, are preferred. Motors of hermetically-sealed compressor units shall be of adequate rating to comply with the test for adequate rating of compressor motors (*see* **7.4.4**).

6.2 Motor Overload Protection — Motors shall be adequately protected against dangerous overheating arising from excessive current.

Note 1 — For AC motors, fuses not incorporating specific time-delay characteristics are not regarded as suitable motor overcurrent protection.

Note 2 — An overload protective device which is inoperative during the process of starting the motor is not regarded as suitable unless another circuit-breaker or fuse is installed in the motor circuit.

6.3 Temperature Controls, Pressure Switches, Motor Starting Relays, Etc — All switching devices in the main motor circuit shall be capable of breaking the stalled current of the motor. All switching devices shall be so designed or located that they are unaffected by moisture present under normal working conditions. They shall be suitable for operation at the applied voltage.

6.3.1 All control gears shall comply with relevant Indian Standards where applicable.

6.4 Cables and Flexible Cords — Flexible supply cords and all cables used shall comply with†IS : 434-1953 Specification for Rubber-Insulated Cables and Flexible Cords for Electric Power and Lighting (for Working Voltages Up to and Including 11 kV) as regards thickness of insulation, insulation resistance, voltage tests and, in the case of flexible supply cords only, colour. The current carrying capacity of each cable and flexible cord shall be adequate for its full-load current. Where a flexible supply cord passes through holes in metal parts such holes shall be shaped or bushed to protect the flexible cord from damage.

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*Since revised.

†Since revised and split into various parts.

6.5 Wiring

6.5.1 The wiring methods, together with the design, arrangement and workmanship employed, shall give full protection to the electrical insulation against mechanical damage and damage from oil, heat, refrigerant, moisture or corrosive materials where these could be encountered. Metal conduit for internal wiring shall be adequately sealed against ingress of moisture.

6.5.2 Wire shall be so spliced or joined as to be mechanically and electrically secured. Unless made with a suitable mechanical connector joints shall be soldered, brazed or fused together and shall be covered with insulation equivalent to that of the wires.

6.5.3 Except where a suitable connector is used, the ends of every conductor other than the free ends of the service cord shall be rendered solid either by soldering or by a suitable form of eyelet. Where mechanical connectors or terminals are used the wire or cords shall be so supported that there is no appreciable mechanical stress on the conductor or terminal.

6.5.4 Soldering fluxes shall not cause corrosion.

6.6 Accidental Contact — Live parts shall be protected by suitable guards, shields or screens of adequate strength and durability so that there is no possibility of making inadvertent contact therewith under normal service conditions. It shall not be possible to touch live parts with the accessibility test probes following the procedure described in *IS : 1401-1959 Specification for Accessibility Test Probes even after the removal of covers or casings which can be removed without the use of tools, or during replacement of the lamp.

6.7 Internal Electrical Components — Internal lamps of screw-cap type shall be mounted in suitable fittings and provided with guards for protection against mechanical damage. Internal fans shall be suitable for operation at the lowest air temperature likely to occur.

6.8 Earthing — Metal casings of the electrical components, metal frame and all exposed metallic parts likely to become alive shall be provided with earthing facilities in accordance with the requirements given in†IS : 302-1960 General and Safety Requirements for Light Electrical Appliances (*Revised*).

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*Since revised.

†Third revision in 1967.

7. TESTS

7.1 Classification of Tests — Tests shall be classified into three groups, namely, (a) Production Routine Tests, (b) Type Tests, and (c) Acceptance Tests.

7.1.1 *Production Routine Tests* — These shall consist of routine tests that would be conducted on each and every unit after completion at the manufacturer's works (*see* 7.3).

7.1.2 *Type Tests* — The type tests shall consist of the test that would be necessary to check up the performance and characteristics of the units and components and shall be carried out by a recognized testing authority who may be the manufacturer if approved by the purchaser. Once a sectional cold room has undergone type tests, any major or essential alterations, which the manufacturer intends to make, shall be reported to the testing authority and further type tests shall be carried out in accordance with the procedure laid down in this standard (*see* 7.4).

7.1.3 *Acceptance Tests* — If the purchaser desires any of the production routine tests to be repeated at the time of purchase, then, where agreed to between the purchaser and the manufacturer, the tests may by carried out at the manufacturer's works; alternatively, the tests may be repeated at the place specified by the purchaser provided that all the arrangements for tests are made by the purchaser at the specified place.

7.2 Samples for Tests

7.2.1 *Type Tests* — One sectional cold room of each size shall be sent along with manufacturer's detailed specifications to the recognized testing authority for purposes of type tests. The sample shall be picked up at random from stock or routine factory production.

7.2.2 *Acceptance Tests* — The number of sample(s) shall be agreed to between the manufacturer and the purchaser.

7.3 Production Routine Tests

7.3.1 *General Running Test* — Each unit shall be given a run to ensure vibration free and thorough running of mechanical parts.

7.3.2 *Door Seal Test* — Door or hatch seals shall be tested to ensure that the gasket or gaskets will grip on a strip of paper not more than 50 mm wide and 0·08 mm thick when the door is closed normally on it.

7.3.3 *Pressure Tests*

7.3.3.1 The manufacturer shall test all parts of the refrigerating system to pressures not less than those given in Table I.

TABLE I MINIMUM TEST PRESSURES

Refrigerant	Chemical Formula	High Pressure Side	Low Pressure Side
		kg/cm^2	kg/cm^2
Ammonia	NH_3	35	19
Dichlorodifluoromethane	CCl_2F_2	19	11
Methyl chloride	CH_3Cl	19	11
Monochlorodifluoromethane	$CHClF_2$	32	18

7.3.3.2 For refrigerants other than those listed the test pressure shall be:

High Pressure Side — The saturation vapour pressure of the refrigerant at 74°C.

Low Pressure Side — The saturation vapour pressure of the refrigerant at 49°C.

In no case shall the test pressure be less than 3·5 kg/cm^2 gauge.

7.3.3.3 No part of the assembly under test shall show signs of leakage or permanent distortion after being subjected to the above tests for a period of not less than two minutes.

7.3.4 *Electrical Tests*

7.3.4.1 *Component tests* — Before assembly, the individual electrical components shall be subjected to insulation resistance and high voltage tests in accordance with the test methods laid down in the relevant Indian Standards.

7.3.4.2 *Assembly tests* — After assembly, the electrical circuits shall be subjected to the following tests:

a) *Insulation resistance* — The insulation resistance between all electrical circuits and the earthed metal parts when measured at normal room temperature with a voltage of not less than 500V DC shall be not less than one megohm.

b) *High voltage test* — The normal insulation of all electrical circuits at room temperature shall be such as to withstand a

high-voltage test of 1 000V RMS applied for not less than five seconds between all circuits and accessible metal parts.

For refrigerating machinery to be connected to circuits of 50V and below the high-voltage test shall be 500V RMS. The test voltage shall be alternating, of approximately sinewave form and of any convenient frequency between 25 and 100 cycles per second.

7.4 Type Tests

7.4.1 Besides all the production routine tests specified in **7.3**, the type tests shall comprise the following.

7.4.2 *Cold Room Tests*

7.4.2.1 *Thermal insulation* — The insulated structure of the cold room after assembly shall be tested by the heat-input method to determine its thermal transmittance. For this purpose the interior of the cold room shall be heated by an electrical heater (or heaters) suitably shielded to prevent radiation to the walls and so located as to ensure a uniform temperature of not less than 15° ± 1·5°C above the estimated ambient temperature of the test room and maintained at that temperature for 30 hours; and the record required for the test taken hourly during the last six hours. The thermal transmittance shall not exceed the value specified.

7.4.3 *Rating Tests*

7.4.3.1 *Preparation of selected units*

a) The cold room and refrigerating machinery shall be assembled and set up as they would be installed in service. All permanently located accessories shall be in their proper places but the storage space shall otherwise be empty during all tests except as limited by the test conditions herein stated. Ice trays where fitted shall be empty.

b) Before the machinery is put on test, it shall be given a minimum run-in period of 24 hours, or sufficient to ensure a thorough working of mechanical parts.

7.4.3.2 *Tests* — The tests shall consist of the following which shall be carried out in accordance with the procedure given in **7.4.3.3** and under general test conditions given in **7.5.1**:

a) Measurement of kWh consumption in 24 hours with the average cold room air temperature and ambient temperature as given in Table II. Rating in kWh shall be based on standard voltage which shall be 230 or 240 single phase, 50 c/s; the unit, however, shall be capable of working at any voltage within ± 10 percent of the standard voltage. In the case of DC machines, standard voltage shall be 220V and the units shall be capable of working within voltage variation of ±5 percent of the standard voltage.

NOTE — Attention is drawn to *IS : 585-1954 Recommended Voltages and Frequency for A.C. Transmission and Distribution Systems where it is recommended adoption of 240 volts single phase in place of 230 volts single phase. In the interim period, however, 230 volts single phase will be permissible voltage.

b) Measurement of percentage running time under the same conditions.

c) Measurement of average cold room air temperature.

7.4.3.3 *Test procedure*

a) Before the start of any test, the refrigerating machinery shall be allowed to operate at test condition for a sufficient length of time to establish equilibrium. The period of stabilization shall be at least 12 hours, and when the cold room temperature has been changed but the ambient temperature held constant, this period of stabilization shall be at least 6 hours. Equilibrium shall be considered to be established when the average cold

TABLE II TEST TEMPERATURES

(*Clauses* 7.4.3.2 *and* 7.4.4)

Ambient temperature	As specified in the contract (*see* **1.1.1**)
Average cold room air temperature	do
Motor-winding temperature, *Max*	
a) Hermetically-sealed compressor unit	Shall be suitable for working in the condition of the sealed unit for which they are applied.
b) Open type condensing unit	Shall not exceed limits of temperature-rise mentioned in *IS : 325-1961 or *IS : 996-1959 whichever is applicable.
Motor-winding temperature-rise above ambient, *Max*	
a) Hermetically-sealed compressor unit	Shall be suitable for working in the conditions of the sealed unit for which they are applied.
b) Open type condensing unit	Shall not exceed limit of temperature-rise mentioned in *IS : 325-1961 or *IS : 996-1959 whichever is applicable.

NOTE — Where a sectional cold room provides two or more storage compartments at different temperatures, the appropriate air temperature in each compartment should be held simultaneously.

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*Since revised.

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*Since revised.

room air temperature does not vary more than 0·5°C in the last 2 hours of the stabilization period.

b) The calculation of the kWh consumption in 24 hours and the percentage running time shall be made from the results of a test lasting at least 24 hours.

7.4.3.4 *Results of tests* — The following information shall be recorded:

a) Ambient temperature,

b) Average cold room air temperature,

c) Consumption in kWh per 24 hours, and

d) Percentage running time.

NOTE — This test is a 'no load' test and does not take into account the effect of product load, air changes, door opening or other loads which may be encountered in normal service. Owing to wide variations in the conditions of service it is not practicable to lay down a common test which will account for these factors for the range of equipment considered in this standard; and the buyer should assure himself that the percentage running time is sufficiently low to ensure a suitable margin to provide for them.

7.4.4 *Test for Adequate Rating of Compressor Motor* — When exposed to the specified ambient temperature, the refrigerating machinery shall pull down from equalized pressure conditions in the system to the specified cold room temperature, and maintain that temperature with the machine running continuously. Controlled heat shall be applied inside the cold room to ensure that the motor runs continuously.

7.4.4.1 To ensure an even cold room temperature, a fan shall be used to circulate the air. Under these conditions the motor winding temperature shall not exceed the value set out in Table II.

7.4.4.2 If any test is interrupted by a self-resetting device protecting the motor from over-current the device should be allowed to restore the circuit as soon as its normal operation permits.

7.4.5 The type test report shall contain name-plate particulars of the cold room for purposes of identification.

7.5 General Requirements for Tests

7.5.1 *Test Conditions*

a) The sectional cold room shall be so placed or shielded as to prevent direct radiation from the heating equipment. Air circulation in the test room shall be such that the specified uniformity of temperature distribution is obtained without a direct draught upon the room under test. Windows in the test room shall be provided with suitable radiation shields. The cold room shall be shielded from extraneous air currents which exceed 15 m per minute.

b) The interior of the cold room shall be dried immediately before the stabilization period preceding the tests.

c) The cabinet door (or doors) shall be kept closed during each test.

7.5.2 *Temperatures*

7.5.2.1 *Ambient temperatures*

a) Ambient temperature shall be maintained to within ±1°C of the specified value, and shall be measured at points located at 1 m from the floor and 0·25 m from the sides and front of the cold room. This condition shall be maintained during both stabilizing and test periods.

b) The ambient temperature shall be recorded at one of the above positions, preferably with a recording instrument. If an indicating instrument is used, readings shall be taken at intervals of 30 minutes.

c) The vertical temperature gradient from the floor to a height of 2 m shall not exceed 1·5°C for each metre of vertical distance.

7.5.2.2 *Internal cold room temperature*

a) Temperature of the cold room air shall be measured in at least six representative positions and the mean shall be taken as the cold room temperature.

b) In the cold rooms where separate compartments are provided, the temperature of each compartment shall be recorded in a number of representative positions as given below:

Size of Compartment	*No. of Positions*
100 litres or less	1
100 to 350 litres	3
350 litres and above	6

c) The cold room air temperature shall be taken with a recording instrument placed approximately at the point of averge temperature; and the temperature drift through the test period shall not exceed 0·3°C.

d) All temperature measuring elements shall be supported in the cold room in such a manner that there will be at least 13 mm of air space separating the thermal element from contact with heat conducting surfaces in the cold room. Connections from the temperature measuring elements shall be brought to the outside of the room in such a manner as to interfere as little as possible with air seals.

7.5.3 *Electric Supply* — The condition specified for tests shall be average values within the following variations:

a) ±2 percent of the standard voltage [*see* **7.4.3.2** (a)], and
b) ±1 percent of the supply frequency [*see* **7.4.3.2** (a)].

7.5.4 *Instruments and Measurements*

a) All instruments used for measuring shall be calibrated against a secondary standard before making each test or series of tests.
b) Temperature measuring instruments shall be accurate to 0·3°C.
c) Watt-hour metres shall be capable of being read to 0·01 kWh.
d) The operating time of the unit shall be obtained by means of a recording meter or a self-starting synchronous electric clock.

8. MANUFACTURER'S GUARANTEE

8.1 The manufacturer shall give a guarantee for the soundness of construction and performance of the cold room, and shall be responsible for putting right any manufacturing defects free of charge for a period of twelve months from the date of sale to the original purchaser or date of inspection or approval in the case of government or semi-government institutions, it being understood that such repairs or replacements of defective parts to be carried out at the manufacturer's works.

9. MARKING

9.1 The sectional cold room shall have the following information marked on a name-plate in a permanent and legible manner in a location where it is accessible and visible:

a) Name of the manufacturer or sponsor of the complete assembled unit;
b) Type, model, catalogue and serial number of the cold room compressor, motor, etc, or sufficient information to provide adequate identification for replacement of parts or necessary servicing;
c) Normal running current, voltage of the supply circuit, and, in the case of AC, the frequency, for which the refrigerating machinery is designed; and
d) The name and maximum weight of the refrigerant used.

9.2 The following information shall be provided by the manufacturer or sponsor of each complete unit, not necessarily in a permanent marking:

a) Operating instructions,
b) Gross storage volume, and
c) Net storage surface.

9.3 Each cold room may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Conversion*
Force	newton	N	1 N = 0·101 972 kgf
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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